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(12) **United States Patent**
Gulati et al.

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(54) **SYSTEMS AND METHODS FOR COLLISION COMPUTING FOR DETECTION AND NONINVASIVE MEASUREMENT OF BLOOD GLUCOSE AND OTHER SUBSTANCES AND EVENTS**

(58) **Field of Classification Search**
CPC G01N 33/49; G01N 33/4833
See application file for complete search history.

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U.S. Appl. No. 14/869,550, filed Sep. 29, 2015, by Gulati et al.

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(57) **ABSTRACT**

A collision-computing system detects and amplifies the energy associated with a feature signal to determine occurrences or absence of events, such as ultrasonic and/or geophysical events, or to determine presence and/or concentrations of substances such as blood glucose, toxic chemicals, etc., in a noisy, high-clutter environment or sample. To this end, a conditioned feature, obtained by modulating a carrier kernel with a feature signal, is collided with a Zyoton—a waveform that without a collision can travel substantially unperturbed in a propagation medium over a specified distance. The conditioned feature and the Zyoton are particularly constructed to be co-dependent in terms of their respective dispersion velocities and the divergence of a waveform resulting from the collision. The collision operation can transfer at least a portion of the feature energy to the resulting waveform, and the transferred energy can be amplified in successive collisions for detecting/measuring events/substances.

114 Claims, 207 Drawing Sheets

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(51) **Int. Cl.**

G01J 5/02 (2006.01)

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(52) **U.S. Cl.**

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